



## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

**“जानने का अधिकार, जीने का अधिकार”**

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

**“पुराने को छोड़ नये के तरफ”**

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 8143 (1976): Plugs and keys for resistance boxes [ETD  
12: Measuring Equipment for Basic Electrical Quantities]

**“ज्ञान से एक नये भारत का निर्माण”**

Satyanaaranay Gangaram Pitroda

“Invent a New India Using Knowledge”



**“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”**

Bhartṛhari—Nītiśatakam

“Knowledge is such a treasure which cannot be stolen”





BLANK PAGE



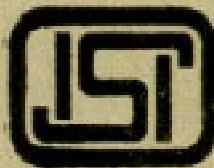
PROTECTED BY COPYRIGHT

IS : 8143 - 1976

## *Indian Standard*

# SPECIFICATION FOR PLUGS AND KEYS FOR RESISTANCE BOXES

UDC 621.317.732



© Copyright 1976

**INDIAN STANDARDS INSTITUTION**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

IS 8143 Gr 2

November 1976

# Indian Standard

## SPECIFICATION FOR PLUGS AND KEYS FOR RESISTANCE BOXES

Electrical Instruments Sectional Committee, ETDC 48

*Chairman*

PROF ( DR ) J. K. CHOUDHURY  
Jadavpur University, Calcutta

*Members*

SHRI V. K. BATRA  
DR A. S. BHADURI

SHRI B. P. GHOSH (*Alternate*)  
SHRI J. L. CHHABRA

SHRI J. S. PASSI (*Alternate*)  
CHIEF ELECTRICAL ENGINEER  
( CENTRAL RAILWAY )  
ADDITIONAL CHIEF ELECTRICAL  
ENGINEER ( CENTRAL  
RAILWAY ) (*Alternate*)

COL R. C. DHINGRA

SHRI R. N. GANDHI

SHRI G. CHANDRASEKARAN (*Alternate*)

SHRI A. N. GHOSH

SHRI P. P. MALHOTRA (*Alternate*)

SHRI D. A. GOPALAKRISHNA

SHRI S. C. ARZARE (*Alternate*)

SHRI K. B. KAMAT

SHRI S. C. MUKHERJEE (*Alternate*)

SHRI S. D. KULKARNI

SHRI B. K. GARODIA (*Alternate*)

SHRI J. R. MAHAJAN

SHRI S. P. RANADE (*Alternate*)

*Representing*  
National Physical Laboratory ( CSIR ), New Delhi  
National Test House, Calcutta

DIRECTORATE GENERAL OF SUPPLIES & DISPOSALS  
( INSPECTION WING ), NEW DELHI

RESEARCH, DESIGNS & STANDARDS ORGANIZATION,  
LUCKNOW

CONTROLLER OF INSPECTION ELECTRONICS ( MINISTRY OF  
DEFENCE ), BANGALORE

INSTITUTE FOR DESIGN OF ELECTRICAL MEASURING INSTRUMENTS,  
BOMBAY

DEVELOPMENT COMMISSIONER, SMALL SCALE INDUSTRIES  
( MINISTRY OF INDUSTRIAL DEVELOPMENT ),  
NEW DELHI

INSTRUMENTATION LTD, KOTA

DIRECTORATE GENERAL OF POSTS & TELEGRAPH ( DEPARTMENT  
OF COMMUNICATIONS ), NEW DELHI

ALL INDIA INSTRUMENT MANUFACTURERS' & DEALERS'  
ASSOCIATION, BOMBAY

INDIAN ELECTRICAL MANUFACTURERS' ASSOCIATION,  
BOMBAY

( Continued on page 2 )

© Copyright 1976  
INDIAN STANDARDS INSTITUTION

This publication is protected under the *Indian Copyright Act* ( XIV of 1957 ) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(Continued from page 1)

*Members*

**SHRI S. S. MAVI**

*Representing*

Department of Industries, Government of Punjab,  
Chandigarh

**SHRI K. L. KOHLI ( Alternate )**

**SHRI K. P. R. NAMBIAR**

British Physical Laboratories India Pvt Ltd,  
Bangalore

**SHRI N. L. RAO ( Alternate )**

**SHRI E. N. NARAYANASWAMY**

Department of Industries and Commerce,  
Government of Tamil Nadu, Madras

**SHRI V. H. NAVKAL**

The Bombay Electric Supply and Transport Under-  
taking, Bombay

**SHRI S. P. BROOTA ( Alternate )**

**CAPT P. R. PARSAD**

Directorate of Standardization, Ministry of Defence,  
New Delhi

**SHRI C. V. K. RAO ( Alternate )**

**SHRI P. V. N. RAMANATHAN**

Central Scientific Instruments Organization ( CSIR ),  
Chandigarh

**DR R. N. MATHUR ( Alternate )**

**SHRI K. N. RAMASWAMY**

Directorate General of Technical Development,  
New Delhi

**SHRI R. S. SOUNDHIRARAJAN ( Alternate )**

**SHRI LAKSHMI SAGAR**

Oriental Science Apparatus Workshop, Ambala Cantt

**SHRI K. S. GUPTA ( Alternate )**

**SHRI DINESH N. SARBAHI**

The Motwane Manufacturing Co Pvt Ltd, Gyan  
Baug, Maharashtra

**DR G. R. TOSHNIWAL**

**SHRI S. C. MAHESHWARI ( Alternate )**

Toshniwal Industries Pvt Ltd, Ajmer

**SHRI M. S. WANDALKAR**

**SHRI S. K. KASLIWAL ( Alternate )**

Bharat Heavy Electricals Ltd, Bhopal

**SHRI S. P. SACHDEV,**

Director ( Elec tech )

Director General, ISI ( *Ex-officio Member* )

*Secretary*

**SHRI HARCHARAN SINGH**  
Deputy Director ( Elec tech ), ISI

# *Indian Standard*

## SPECIFICATION FOR PLUGS AND KEYS FOR RESISTANCE BOXES

### 0. F O R E W O R D

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 28 July 1976, after the draft finalized by the Electrical Instruments Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** Plugs and keys are used with electrical apparatus, such as, resistance boxes and post office boxes for inserting and short circuiting the resistance as desired. In view of a large variety of design and dimensions of plugs and keys manufactured by the different manufacturers, it is considered rather difficult to achieve dimensional standardization for the necessary interchangeability. However, it has been felt that a suitable standard for plugs and keys prescribing minimum requirements would be useful for an individual manufacturer in ensuring proper quality of these components.

**0.3** The requirements of the associated electrical apparatus, such as, resistance boxes and post office boxes are covered in IS : 1565-1966\*.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

---

### 1. SCOPE

**1.1** This standard specifies the requirements and tests for plugs and keys used in electrical apparatus, such as, plug type resistance boxes and post office boxes.

### 2. TERMINOLOGY

**2.0** For the purpose of this standard, the following definitions shall apply.

---

\*Specification for electrical apparatus comprising resistors (*revised*).

†Rules for rounding off numerical values (*revised*).

**2.1 Base Plate** — The insulated plate on which keys are mounted.

**2.2 Keys** — Blocks of metallic part to which resistors are fitted on the base.

**2.3 Lug** — The metallic portion of the plug moulded in the insulating material.

**2.4 Plug** — A device for inserting into a gap between two key blocks for making continuity.

**2.5 Stud** — Metallic terminations attached to keys for connecting the resistors.

### **3. MATERIALS**

**3.1 Base Plate** — It shall be of a suitable insulating material, such as, bakelite or ebonite.

**3.2 Keys** — The keys shall be of brass free from mechanical defects.

**3.3 Plugs** — The top of the plug shall be of a suitable insulating material with lug rigidly moulded in it.

**3.4 Lug** — The lug shall be made out of specially treated brass rods free from mechanical defects.

**3.5 Stud** — It shall be of brass.

### **4. CONSTRUCTION**

**4.1 Base Plate** — The base plate shall be solid insulating sheet of thickness not less than 9 mm and shall meet the requirements of IS : 2036-1974\* depending upon the maximum range of the resistors to be mounted on the base plate.

**4.2 Keys** — The keys (metallic blocks) shall have a minimum contact area of  $12.5 \text{ mm}^2$  and a suitable length to allow easy handling of plug tops. The studs shall be appropriately connected to the key blocks where it is not an integral part of the key block in order to minimize the contact resistance. Blocks shall be fixed by suitable means so as to avoid misalignment. The blocks shall be given a protective coating against corrosion except the contact area. The consecutive blocks shall be separated with a minimum gap of 1 mm and shall have a tapered hole to match the taper of the plug to be inserted.

**4.3 Plugs** — The insulated top of the plug shall be suitably shaped for easy handling.

---

\*Specification for phenolic laminated sheets (*first revision*).

**4.4 Lugs** — The lugs shall be of diameter not less than 8 mm to withstand wear and tear. These shall be turned to a fixed taper for interchangeability.

**4.5 Stud** — The diameter of the stud ( screws, if of screw type ) shall be not less than 4 mm.

## 5. PACKING AND MARKING

**5.1 Packing** — Plugs and keys are usually supplied with the associated apparatus. When not accompanying the associated apparatus, they shall be packed in suitable containers and labelled.

**5.2 Marking** — The label which is to be securely attached to the container shall have the following information:

- a) Manufacturer's name or trade-mark;
- b) Manufacturer's serial number; and
- c) Country of manufacture.

**5.2.1** The label may also be marked with the ISI Certification Mark.

**NOTE** — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## 6. TESTS

**6.1 Type Tests** — The following shall constitute the type tests and shall be carried out in the sequence given below:

- a) Insulation resistance test ( **6.4** ),
- b) High voltage test ( **6.5** ), and
- c) Contact resistance test ( **6.6** ), and
- d) Mechanical endurance test ( **6.7** ).

**6.2 Acceptance Tests** — The following shall constitute the acceptance tests and shall be carried out in the sequence given below:

- a) Insulation resistance test ( **6.4** ),
- b) High voltage test ( **6.5** ),
- c) Contact resistance test ( **6.6** ), and
- d) Mechanical endurance test ( **6.7** ).

**6.2.1 Sampling Plan and Criteria for Acceptance** — A recommendatory sampling plan and criteria for acceptance of lot are given in Appendix A.

**6.3 Routine Tests** — The following shall constitute the routine tests and shall be carried out in the sequence given below:

- a) Insulation resistance test (**6.4**),
- b) High voltage test (**6.5**), and
- c) Contact resistance test (**6.6**).

**6.4 Insulation Resistance Test** — The insulation resistance between the plug and its top when measured at  $500 \pm 50$  V dc after one minute of electrification shall be not less than  $100 \text{ M}\Omega$ .

**6.5 High Voltage Test** — No breakdown, arcing or sparking shall occur when an ac voltage of 1000 V (rms) is applied gradually across the plug and its top and maintained for a period of one minute.

## **6.6 Contact Resistance Test**

**6.6.1 General Measuring Requirements** — Measurement may be carried out with direct current or alternating current. In the case of dispute, the dc measurement shall govern.

**6.6.1.1** The contact resistance shall normally be calculated from the potential difference measured between the points intended for connection of the wiring. The contact shall be made before the measuring voltage is applied.

**6.6.1.2** In order to prevent the breakdown of insulating films on the contacts, the emf of the measuring circuit shall not exceed 20 mV (dc or ac peak).

**6.6.1.3** In order to prevent undue heating of the contacts, the current flowing shall not exceed 1 A. For ac measurements the frequency shall be  $1 \text{ kHz} \pm 200 \text{ Hz}$ .

**6.6.1.4** The measuring apparatus shall be such as to ensure an accuracy of  $\pm 10$  percent.

**6.6.1.5** The measurement shall consist of determination of the mean value of the contact resistance of the contacts of mated sets of plugs and keys ( $R$ ).

## **6.6.2 Measuring Cycle**

**6.6.2.1 Measurement with dc** — One measuring cycle consists of:

- a) making the contact,
- b) connection of voltage source,

- c) measurement with current flowing in one direction,
- d) measurement with current flowing in opposite direction,
- e) disconnection of voltage source, and
- f) breaking the contact.

**6.6.2.2 Measurement with ac** — One measuring cycle consists of:

- a) making the contact,
- b) connection of voltage source,
- c) measurement,
- d) disconnection of voltage source, and
- e) breaking the contact.

**6.6.2.3 Measuring cycles** shall be carried out in immediate succession.

**6.6.3 Measurement on Mated Sets** — The number of contacts to be measured shall be 10.

**6.6.3.1** There shall be five measuring cycles. The average of the values per contact thus obtained is the resistance of the contact under test ( $R$ ). The value of any individual measurement shall not exceed twice this value.

**6.6.4 Requirement** — The value of the contact resistance ( $R$ ) shall not exceed 3 milliohms.

**6.7 Mechanical Endurance Test** — The keys and plugs shall be tested by actual operation 10000 times. After 10000 operations, there shall be no mechanical deterioration in the working of the plugs and keys.

**6.7.1** After this test, the contact resistance test shall be carried out. Subsequently, the plugs and keys shall be tested with the associated apparatus for resistance accuracy in accordance with 7.4 of IS:1565-1966\* and shall comply with the requirements specified in 7.4.2 (a) of IS:1565-1966\*.

## A P P E N D I X A

( Clause 6.2.1 )

### RECOMMENDED SAMPLING PLAN AND CRITERIA FOR ACCEPTANCE

#### A-1. LOT

**A-1.1** In any consignment, all plugs and keys of the same type, and manufactured under similar conditions of production shall be grouped together to constitute a lot.

\*Specification for electrical apparatus comprising resistors ( revised ).

**A-1.2** Plugs and keys shall be tested from each lot for ascertaining the conformity to the acceptance tests.

### **A-2. SCALE OF SAMPLING**

**A-2.1** The number of plugs or keys to be selected from each lot shall be in accordance with Table 1. These keys and plugs shall be selected at random (*see IS : 4905-1968\**).

**TABLE 1 SCALE OF SAMPLING AND CRITERIA FOR ACCEPTANCE**

LOT SIZE	FIRST STAGE $N_1$	SECOND STAGE $N_2$	$N_1 + N_2$	$C_1$	$C_2$	$C_3$
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 25	2	2	4	0	2	2
26,, 100	3	3	6	0	2	2
101,, 300	5	5	10	0	2	2
301,, 500	8	8	16	0	2	2
501 and above	13	13	26	0	3	4

### **A-3. NUMBER OF TESTS AND CRITERIA FOR ACCEPTANCE**

**A-3.1** Each of the plug or key selected in the first stage in accordance with col 1 and 2 of Table 1 shall be tested for acceptance tests (*see 0.2*). A plug or key shall be called a defective if it fails in any of the acceptance tests. If the number of defectives is equal to  $C_1$ , the lot shall be considered as conforming to the requirements of the acceptance tests. If the number of defectives is greater than or equal to  $C_2$ , the lot shall be declared to have failed in acceptance tests. If the number of defectives are between  $C_1$  and  $C_2$ , a further sample of same size as taken in the first stage shall be taken and tested. If the number of defectives in the two samples combined is less than  $C_3$ , the lot shall be considered as conforming to the requirements of acceptance tests, otherwise not.

\*Methods for random sampling.